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Vaccination and natural immunity: Advantages and risks as a matter of public health policy

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Vaccine mandates support public health by providing protection against a particular disease, but these mandates have sparked significant controversy when required as part of public health policy.[1] One often discussed issue involves the multiple pathways to immunity, especially vaccine-induced immunity and natural immunity following infection.[2] Although both methods provide some level of immunization, they create substantially different concerns for policy—and substantially different risks for the individual, as natural immunity requires becoming infected. Their contrast should consider medical science, including the relative protection offered by each pathway. However, the larger debate must also address practical and logistical issues when applying immunization requirements through public policy. Here we will discuss these issues with lessons learned from applying vaccine mandates to a military population that required full vaccination of all personnel.

Foremost, the scientific evidence must be considered. Specific to SARS-CoV-2, some results suggest that vaccine-induced immunity is more effective,[3] other results suggest that natural immunity is more effective,[4] and some findings estimate both options as roughly equal.[5] All evidence appears to support that prior immunity helps reduce frequency of severe outcomes and prevents future infections. The scientific evidence thus supports an advantage for some level of protection beyond unvaccinated and uninfected, but further study is needed. Alternatively, public health professionals must weigh additional information than efficacy alone when building policy. Among the many possible factors, three key issues must be considered when determining whether vaccine mandates should accommodate immunity following prior infection: (1) risk exposure; (2) reliability; and (3) sustainment.

Risk exposure is the first issue. Notably, each pathway to immunity exposes individuals to different levels of risk. People could have adverse reactions to vaccines or severe outcomes due to infection. Adverse effects have been minimal for COVID-19 vaccines,[6,7] indicating a nominal level of risk exposure. SARS-CoV-2 exposure, meanwhile, carries significant and well-documented dangers.[8] Risk therefore becomes the cornerstone for making public health policy decisions as the vaccine is far safer than natural infection.

Reliability is the second issue. Without reliable information about the conditions conferring immunization, it becomes difficult to build policy. Vaccination uses the same formula each time, the same dosage, and with an identifiable date of vaccination, waning immunity can be documented with high reliability. Natural immunity is highly variable by comparison. People may not know which strain infected them without further testing, viral load during the infection, or precisely when their exposure occurred. Asymptomatic individuals may know none of this information. Serology testing for SARS-CoV-2 antibodies could also be unreliable due to timing and current serology test performance characteristics.[9] Vaccines thus provide a more reliable option than natural infection when constructing policy.

Sustainment is the third issue. COVID immunization may not result in lasting immunity,[10] and so public health policy must consider requirements to sustain immunity among the population. Tracking vaccine-induced immunity is relatively simple due to higher reliability. In turn, coordinating booster shots becomes easier because protocols can be optimized in accordance with prior vaccination. Boosters for natural infections are more difficult to coordinate. If date of infection is unknown, as with asymptomatic cases, and duration of waning immunity is unknown, as with most COVID cases, it becomes exponentially more difficult to build any consistent or meaningful policy. Vaccines represent the better option around which to coordinate boosters and ensure continuing immunity.

All three factors—risk exposure, reliability, and sustainment—support building public health policy around vaccines as the safest option. We have observed these differences in practice when implementing a vaccine mandate among military personnel. With the vaccine, logistical concerns around tracking have been much simpler than COVID-19 case counts. For example, we can track vaccinations as a percentage of total force, but we cannot fully track every case due to asymptomatic infections or mild symptoms left undocumented.

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Baseline health characteristics introduce another variable as military personnel have much better physical fitness and fewer underlying medical conditions than the general population. So, a military population has relatively lower risk exposure. Still, military policy must focus on force health protection and sustaining any protection through natural immunity would be logistically too complex, unreliable, and require continued exposure to the virus. Vaccines provide lower risk, higher reliability, and better logistical tracking. Ultimately, policy may need to consider both vaccine-induced immunity and natural immunity following infection, but only one option produces a viable and sustainable solution to support public health.

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Declaration of interests

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